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ABSTRACT

This paper investigates the effect of IT on a firm's procurement governance. While some scholars posit that IT-enabled reduction in transaction costs will lead to more electronic markets, others claim that electronic partnerships will be the predominant governance for procurement. Empirical evidence about the IT effect on procurement governance is mixed. We argue that the phase of the industrial innovation dynamics, at which suppliers are in, will affect the type of predominant governance. More specifically, when suppliers are in the phase of product/process innovation, e-markets will be the predominant governance. However, e-partnerships will become a better choice when suppliers are in the maturity phase. Additionally, we argue that e-procurement governance will keep change as industrial innovation evolves from one phase to another. Our main contribution is to put e-procurement governance into the context of industrial innovation dynamics. The research and practical implications of our framework are discussed.

Keywords

E-procurement governance, industrial innovation dynamics, inter-firm process innovation

INTRODUCTION

B2B procurement through electronic links (e-procurement hereafter) has increased in popularity in recent years. IDC predicts that e-procurement will grow from US$225 billion in 2002 to about US$ 1.5 trillion by 2006 (Hamblen, 2002). A pan-European report by Datamonitor predicts transaction volume on private exchanges to rise from £8 billion in 2001 to £420 billion in 2005 (Parker, 2001). Generally, there are two types of B2B e-procurement governance for firms: electronic markets and electronic partnerships (e-markets and e-partnerships hereafter; Malone et al. 1987, p.485). The e-markets governance is characterized by loose-coupling linkages with low specificity in the site, physical asset, and human asset (Williamson, 1975). Furthermore, there usually are a large number of participants who are with contractual relationships and low interdependence. On the contrary, the e-partnerships governance involves tight-coupling, dedicated inter-organizational linkages with high specificity and there are only a few participants with deep relationships and high interdependence (Gosain et al., 2002).

Although e-procurement has increasingly become a strategic necessity for today's firms, it is still not clear in the literature what type of e-procurement governance is best (Dai and Kauffman, 2003). The "electronic markets hypothesis" suggested that firms will prefer e-markets to e-partnerships due to IT-enabled reduction in transaction costs (Malone et al., 1987). However, this proposition was challenged by another view which suggested that a partnership might be more adequate (Clemons et al. 1993; Bakos and Brynjolfsson, 1993). The empirical studies about the IT effect on procurement governance also present contradictive results (e.g. Steinfield et al. 2000). In an effort to address this IT effect, recent studies have included contingent factors. The basic idea is that e-markets or e-partnerships may not be better than its counterpart universally. A firm's best e-procurement governance will depend on contingent factors such as market complexity, business strategy, firm size, operation costs, information sharing, competition etc. (Holland and Lockett, 1997; Kauffman and Mohtadi, 2002; Mithas et al., 2002; Dai and Kauffman, 2003).

However, an environmental factor - the innovation dynamics in suppliers' industry - has been overlooked in the literature. We believe that this factor is a key contingency for e-procurement governance since the industrial context can influence a firm's strategic decisions. Also, using the framework of innovation dynamics has the additional advantage of addressing the issue of how a buyer's e-procurement governance might evolve over time. This paper attempts to study the effect of IT on a buyer's procurement governance in the context of innovation dynamics in suppliers' industry (Utterback and Abernathy, 1975). Utterback and Abernathy's framework takes the whole life of industrial innovation into account and is dynamic inherently. Thus, it can provide insights in both firms' adoption and shifts of e-procurement governance. In section 2, we review the premises of e-markets and e-partnerships in literature. Then, we develop a conceptual framework for e-

procurement governance choices in the context of innovation dynamics. We conclude this paper by discussing the research and practical implications of our framework.

E-MARKETS VS. E-PARTNERSHIPS

Since the latter half of the 1980s, researchers have paid lots of attention to the effect of IT on a firm's procurement governance. Malone et al. (1987) suggested that IT reduces coordination costs by lowering communication and information processing costs, facilitating the description of complex products, and decreasing asset specificity in procurement. They also believed that market governance is more coordination intensive than hierarchical governance. Therefore, IT-enabled reduction of coordination costs generally lead firms to rely more on e-markets than e-partnerships to coordinate procurement[1].

Malone et al.'s prediction is consistent with the today's observation that a buyer can connect to more suppliers through online marketplaces. For example, via marketplaces such as www.WorldWideRetailExchange.org and www.GNX.com, retailers can reach suppliers globally. Automakers, such as GM and Ford, use www.FreeMarkets.com for auto components auctions. www.ChemConnect.com provides its members with advanced services, such as online auction and reverse auction, online marketplace, and commodity exchange, for chemicals and related products.

However, there exists a different view about the effect of IT on a firm's procurement governance (Clemons et al. 1993; Bakos and Brynjolfsson, 1993). Although Clemons et al. agreed with Malone et al. about an IT-induced increase in outsourcing, they argued that firms will partner with a smaller set of long-term suppliers, rather than use market mechanism. Their main idea is that IT-enabled reduction in coordination costs will lead to more explicit coordination, such as joint negotiation and decision making, which can benefit both firms. At the same time, increasing in explicit coordination involves significant investment in relationship-specific capital, such as the investment in human relationships and organizational processes. These fixed relationship-specific investments will lead to transactional economies of scale with fewer suppliers. Also, long-term relationships become desirable since firms need time to recoup these investments and to learn how to make effective explicit coordination. Furthermore, a long-term relationship with few suppliers can motivate suppliers to make noncontractible investments, such as quality, innovation, and information sharing (Bakos and Brynjolfsson, 1993), and can economize on search costs to deal with greater product differentiation.

Similarly, there also exist examples in today's economy that are consistent with Clemons et al.'s argument. For instance, DELL usually works with only few suppliers for each major component, e.g. with Seagate, Maxtor, Western Digital and IBM for disk drives (Dedrick and Kraemer, 2002). Wal-Mart develops supply chain partnerships with major suppliers through its private system-Retail Link. The partnership between Wal-Mart and Procter & Gamble incorporates vendor managed inventory, category management, and other inter-firm innovations (Byrnes, 2003).

The contradictive predictions between "e-markets" and "e-partnerships" are worth empirical examination. Since Malone et al. made their prediction based on the assumption that the necessary IT infrastructure already exists and, hence does not influence transaction costs (O'Mahony and Barley, 1999, p.141) and Clemons et al.'s hypothesis was based on the fact of decreasing in IT costs and increasing in IT standardization (1993, p. 17), their competitive predictions should be tested empirically in the context of open IT networks where IT itself is not a kind of specific assets which will necessitate e-partnerships (Williamson, 1975). In fact, these two competitive hypotheses become more relevant in today's economy due to the coming of Internet and the increasing standardization in IT, such as the recent development in XML and Web Services.

However, the empirical evidence about the IT effect on procurement governance is mixed. Consistent with the "e-markets" argument, there was an evolution to e-markets in airline industry with the coming of public computer reservation systems (Malone et al. 1987, p.492). Also, with the open electronic business interfaces – RosettaNet Partner Interface Processes, partnering flexibility, which is the easiness of changing supply chain partners in response to changes in the business environment, has increased in the IT industry (Gosain et al., 2002).

Consistent with the "e-partnerships" argument, Hess and Kemerer (1994) found that although there are two e-marketplaces emerging in the home mortgage industry, they are not successful and exit after a short period. The most successful system in that industry is best characterized as an e-hierarchy. Similarly, Streeter et al. (1996) found that the more a firm uses open networks– the Teletel system in France, the more stable are its relationships with its customers. A typical customer trades with such firm more frequently and for a longer duration.

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[1] According to Malone et al.'s (1987, p.485) definition, the inter-firm partnership is a kind of hierarchies. Since we only focus on inter-firm governance, the term "hierarchy" means "partnership" in this paper.

Furthermore, some scholars showed mixed results. Steinfield et al. (2000) found that the Internet use is related to increased computer-based access to a firm from external constituents, which could then open the door to trade with many more firms. They also showed evidence that Internet use does appear to have reduced lock-in – the proportion of inputs acquired with key suppliers decrease. At the same time, they found that greater use of the Internet was associated with more investment in equipment and software in order to do business with specific suppliers. Holland and Lockett's (1997) case studies suggested that IT is compatible with both markets and partnerships.

In sum, theoretical and empirical studies about the IT effect on procurement governance do not converge. Both "e-markets" and "e-partnerships" argument are supported by certain empirical evidence. Recent studies have taken a contingency view. The basic idea is that IT can facilitate both markets (Malone et al., 1987) and partnerships (Clemons et al., 1993). There are contingent factors that influence how firms use IT. For example, Holland and Lockett (1997) suggested that a firm's e-procurement governance may depend on factors such as market complexity and business strategies. In fact, Malone et al. (1987, p.496) already noticed that e-partnerships might be desirable for some firms, although they proposed the "e-markets hypothesis". Similarly, Bakos and Brynjolfsson (1993) also pointed out that the benefits from partnerships will depend on the extent of non-contractible investments.

Using analytic model, Kauffman and Mohtadi (2002) showed that firm sizes play a determinant role in a firm's choice on e-procurement governance. Their model suggested that larger firms tend to adopt costlier, but more certain, e-partnerships. On the contrary, smaller firms tend to adopt less costly e-markets. Dai and Kauffman (2003) studied the effects of search and operation costs, information sharing, and competition on a firm's choices on e-procurement governance. Their analytic model suggested that a buyer will choose e-markets when the supplier's competitive advantage is modest compared with the efficiency benefits that e-markets create. But a buyer will prefer e-partnerships if a supplier derives great competitive value from favorable access to strategic information via e-partnerships and such value has a big impact on the buyer's net benefit.

The contingency framework might provide a promising way to understand the IT effect on procurement governance. Studies along this line just begin and more efforts are needed to identify other important contingencies. We believe that the dynamics in industrial innovation (Utterback and Abernathy, 1975) might help explain the confusing state of conceptual and empirical research regarding e-procurement governance. This factor is important because the industrial context has been long recognized as an influential, even determinant, factor on a firm's strategic decisions (Porter, 1981). For example, Mauri and McMillan (1999) have shown that industrial innovation dynamics affects the governance form of strategic alliance. Therefore, examining the effect of industrial innovation dynamics should help our understandings on a firm's e-procurement governance.

Additionally, although e-procurement governance has been long studied, we still do not have a clear understanding about its evolution (Dai and Kauffman, 2003). A firm's e-procurement governance may change over time. For instance, the steel industry has undergone a shift from public marketplaces to private marketplaces (Bagsarian, 2001). A dynamic framework is needed to deepen our understandings about why a firm may shift from one governance mechanism to another over time. Based on Utterback and Abernathy's (1975) framework, we develop a dynamic framework for e-procurement governance in this paper.

LINKING INNOVATION DYNAMICS TO E-PROCUREMENT GOVERNANCE

According to Utterback and Abernathy (1975), there exists an innovation pattern in most industries according to innovation type and innovation rate. Correspondingly, the industrial innovation can be divided into three phases: product innovation, process innovation, and maturity phase (Figure. 1). Our conceptual framework is based on the innovation pattern in suppliers' industry.

Phase 1: Product Innovation

In the phase of product innovation, product design is fluid and substantial product variety exists across suppliers. Suppliers mainly focus on product performance improvement since it is the main source of high margins. On the other hand, process innovation is minor in this phase. Successive product innovation ultimately yields a "dominant design" which will lead to the process innovation phase.

In this phase, there is a large variance in the product performance across suppliers since the product design is not stable and suppliers have different capabilities in catching unpredictable opportunities in product innovation (Utterback and Abernathy, 1975). Therefore, a *buyer* may prefer market governance since it can probably find a product with excellent or innovative functionalities in the market. At the same time, since product innovation is intensive and unpredictable, it may be unwise for

a buyer to make costly relationship-specific investments to build e-partnerships with a particular supplier. For instance, if this supplier cannot catch an important product innovation, it will prevent the buyer from getting better products.

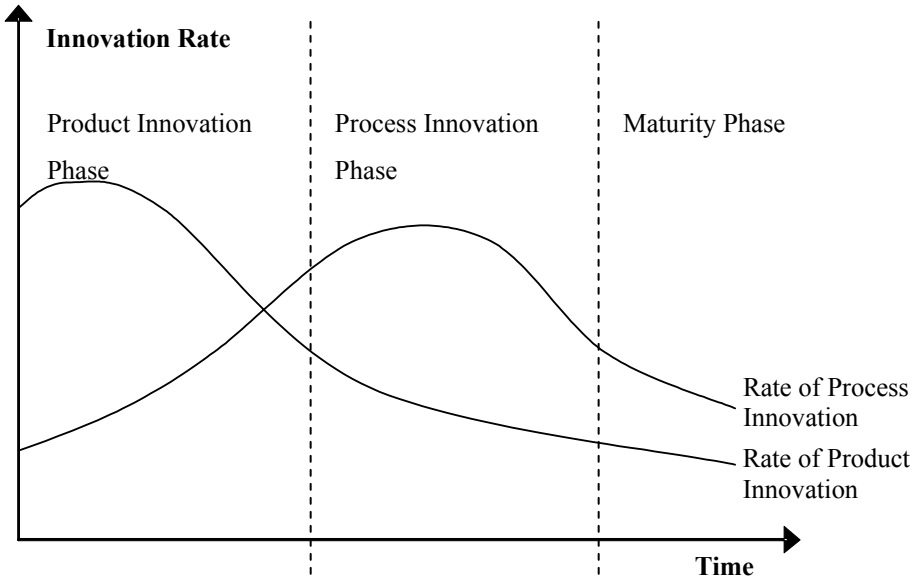

Figure 1. Industrial Innovation Dynamics

On the other hand, a *supplier*'s competitive emphasis in this phase is functional product performance (Utterback and Abernathy, 1975) and it will put its main efforts on product innovation. These product innovations are generally modular innovation (Henderson and Clark, 1990) that can take place within an independent supplier[2]. There is no need for a buyer firm's involvement in these product innovations (Chesbrough and Teece, 1996). Therefore, the incentive of a supplier to partner with a buyer is also low. Since both sides are not willing to develop partnerships, firms may use IT mainly for facilitating transaction in the market. As such, we propose:

Proposition 1: E-markets will be the predominant governance for procurement when suppliers are in the phase of product innovation.

Phase 2: Process Innovation

In the phase of process innovation when product design has become stable, suppliers increasingly employ automated production methods to make production more efficient. Cost reduction through process innovation becomes the strategic focus of a supplier (Utterback and Abernathy, 1975). As the production process becomes more highly developed and integrated, the improvement of process elements becomes increasingly more difficult. Eventually, both the rate of process innovation and the marginal return on process improvement diminish.

In this phase, suppliers already shift their competitive focus to process innovation since the cost becomes strategically important. Similarly, there is a large variance in product prices across suppliers since suppliers have different capabilities in catching these unpredictable innovation opportunities in processes. Therefore, *buyers* may prefer market governance since it is easy for them to find a product with a low price in the market. At the same time, a buyer may not be willing to make relationship specific investment to partner with a particular supplier since this may lock itself to that supplier who may not have the ability to catch innovation opportunities in processes.

[2] We view the whole supply chain as the system (architecture) and individual firms as module in this paper. For simplicity, this paper only considers industries where product innovation is a modular effort. Architectural product innovation may require technological partnership (Chesbrough and Teece, 1996). However, this partnership is not relevant to IT and out of the scope of this paper.

On the other hand, these process innovations generally are modular innovation (Henderson and Clark, 1990) that can take place within the *supplier*'s boundary[3]. A buyer firm's involvement seems not relevant to these internal process innovations. Therefore, suppliers would focus on internal process issues which have strategic significance, rather than put their efforts into developing partnerships which is less important to them. Since partnerships are not desirable for both sides, IT again is used mainly for facilitating transaction in the market. As such, we propose:

Proposition 2: E-markets will be the predominant governance for procurement when suppliers are in the phase of process innovation.

Phase 3: Maturity Phase

In this phase, both product innovation and internal process innovation in suppliers' industry are almost done. The product becomes undifferentiated and the process becomes similar across suppliers with the diffusion of innovation. Therefore, it turns to be difficult for a buyer to find a good deal in markets. With the stabilization of products and internal processes, inter-firm process innovation, which is enabled by IT, may turn to be the only source of value generation for both suppliers and buyers[4]. However, unlike modular product/internal process innovation, inter-firm process innovation is a kind of architectural innovation (Henderson and Clark, 1990) that requires the collaboration between buyers and suppliers.

Generally, market governance fits modular innovation, but architectural innovation requires hierarchical governance (Chesbrough and Teece, 1996). The reason is that market and hierarchy mechanism provide different incentives and coordination abilities for modular and architectural innovation. In the case of modular innovation, such as an improvement in automobile engine, an individual engine supplier has the ability to conduct the innovation. Also, competitive forces in the market can provide higher incentives to the supplier for this innovation. Thus market mechanism is desirable. On the contrary, an architectural innovation, such as inter-firm just-in-time (JIT) programs, involves changes in both suppliers and buyers. Furthermore, these changes in two firms are usually interdependent with each other. As such, this kind of architectural innovation in inter-firm process requires bilateral coordination and related investments are probably dedicated to that specific relationship. To safeguard these specific investments, partnerships, rather than market governance, are required (Williamson, 1975). Since the inter-firm process innovation becomes the main source of value generation for both suppliers and buyers in this phase and it requires e-partnerships governance, we propose:

Proposition 3: E-partnerships will be the predominant governance for procurement when suppliers are in the maturity phase.

The industrial innovation is dynamic in nature and it evolves from product innovation, process innovation, to maturity phase. Since each technology has its own innovation pattern, we would better conceptualize the industrial innovation as a cycle: after one technology becomes mature, another totally new technology will emerge (Anderson and Tushman, 1990). Therefore, a firm's e-procurement governance will change over time. For instance, with the emerging of a new technology, firms may shift to e-markets from e-partnerships since lots of unpredictable opportunities in product innovation and internal process innovation for suppliers emerge again.

DISCUSSIONS

We think that both "e-markets" (Malone et al., 1987) and "e-partnerships" hypothesis (Clemons et al., 1993) only tell a part of the story and they can be integrated in the context of industrial innovation dynamics. For instance, Malone et al. assumed that market transaction involves more coordination on which IT can play a significant role. This may be true in the product/process innovation phase. However, with lots of inter-firm process innovations, such as Just-In-Time and CRP, in the maturity phase, partnerships may become more coordination-intensive. If the partnership is more coordination intensive, IT enabled reduction in coordination costs will favour more partnerships, instead of markets.

Furthermore, the foundation for "electronic markets hypothesis" is that market governance has an advantage in production costs (Malone et al., p.485). This is true for product/process innovation phase. However, this advantage may be overstated in the maturity phase when all suppliers have similar production capabilities. In the maturity phase, rather than use IT to search for a better deal in markets, a firm may prefer to do IT-enabled inter-firm process innovation with its supply partners and gain more from the price discount, better return policy, or better payment terms offered by its partners (Raghunathan, 2003).

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[3] We only consider internal process innovation in suppliers in this phase since Utterback and Abernathy's (1975) focus is within one firm. In fact, there also exist lots of inter-firm process innovations, which we will discuss in the maturity phase.

[4] Perhaps today's increasing competition based on the whole supply chain, instead of individual firms (Kumar, 2001), may reflect the maturation in products and internal processes.

Similarly, the "e-partnerships" argument may overstate the importance of "explicit coordination" (Clemons et al. 1993, p.18). In fact, explicit coordination is a kind of inter-firm process innovation that requires costly relationship-specific investment. It makes essential sense only in the maturity phase. When product/internal process innovations are intensive in suppliers' industry, market governance will provide higher incentives for suppliers to catch those innovation opportunities, especially when these innovations are modular (Chesbrough and Teece, 1996). In these two phases, using partnerships with high level of explicit coordination may not only hurt a supplier's incentives in innovation, but also lock the buyer firm to a possibly inferior supplier.

While Utterback and Abernathy's (1975) framework provides additional insights for the IT effect on procurement governance, we think that IT research also can contribute to extend their framework. Utterback and Abernathy only focus on the innovation within one firm. However, with the aid of IT, process innovation also can take place outside a firm's boundary. It is not surprising that Utterback and Abernathy only focused on the internal process innovation at that time when IT was not widely used. Without the aid of IT, particularly inter-organizational systems, inter-firm process innovation such as CRP and VMI seems impossible. However, industrial innovation pattern may be different nowadays when IT is used everywhere. Specifically, there may come an additional phase in the industrial innovation pattern – the inter-firm process innovation phase.

We distinguish intra-firm process innovation from inter-firm one since they have distinct characteristics. Generally, intra-firm process innovation is under a sole authority that is based on the common ownership. It will be a little easier to initiate intra-firm than inter-firm process innovation, which involves two independent firms. Furthermore, it is believed that to fully realize the potential value of inter-firm process innovation, intra-firm process innovation is required (Truman, 2000). Therefore, we argue that intra-firm and inter-firm process innovation can be viewed as two successive phases. In fact, the shift from early intra-firm BPR to today's inter-firm X-engineering in practice (Champy, 2002) may reflect this idea. Future research can further investigate the idea that there may exist four phases in the industrial innovation: product innovation, intra-firm process innovation, inter-firm process innovation, and maturity phase, rather than three phases.

CONCLUSIONS

The effect of IT on procurement governance has been long studied in IS literature. Based on the review on related studies, we suggest that the contingency framework is promising approach to understand this IT effect. This line of studies just begins and more efforts are needed to identify other critical contingencies. In addition, although e-procurement governance may be dynamic, its evolution is still not well understood. In order to really understand the IT effect on procurement governance over time, a dynamic framework is needed.

This paper argues that the effect IT on procurement governance should be examined in the context of industrial innovation dynamics. Based on Utterback and Abernathy's (1975) framework, we suggest that firms will favor different e-procurement governances in different phases of industrial innovation. When suppliers are in the phase of product/ process innovation, e-markets will be the predominant governance. But e-partnerships become more predominant when suppliers are in the maturity phase. Furthermore, since industrial innovation is a cycle, the predominant e-procurement governance will change over time. As such, our analyses provide insights on both firms' adoption and shifts on e-procurement governance.

The main contribution of this paper is to put the IT effect on procurement governance into the context of industrial innovation dynamics. Our conceptual framework also helps interpret the contradiction between the "e-markets" and the "e-partnerships" hypothesis in the literature. We think that these two hypotheses focus on different phases in the industrial innovation pattern. Our holistic and dynamic framework integrates these two views and helps deepen the understanding about a firm's e-procurement governance.

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